Rocky Flats STCG Technology Needs

Legend

** next to the ID number indicates a "new" technology need/opportunity not identified on the FY 1996 list.

KH Kaiser-Hill (Managing and Integrating Contractor)

RMRS Rocky Mountain Remediation Services

SSOC Safe Sites of Colorado

Decontamination and Decommissioning (D&D)

Characterization of Contaminated Surfaces (RF-DD01) (TRU v. Low Level)

There is an opportunity to implement improved surface characterization methods for radiological contamination on piping (including ducts), tanks, and gloveboxes. Methods should be able to distinguish between surface contamination levels that would correspond to waste ultimately being classified (via final assay) as TRU waste versus low-level waste. The ability to segregate TRU waste from low-level waste more effectively and efficiently prior to packaging can result in greatly reducing the amount of low-level material that is classified and managed as TRU waste. Although current characterization methods are adequate for measuring contamination on flat and easily accessible surfaces, it is a much greater challenge to characterize radioactivity on piping, tanks, and gloveboxes. Of particular interest is a technology's ability to correct for high background levels of contamination. In addition, ideally, a technology would be capable of measuring contamination beneath painted surfaces. Other desired improvements include faster count times, better accuracy and precision, and increased mobility and ease of field deployment. The primary driver is cost savings via reduction of the quantity of material classified at TRU waste.

Improved low level versus free release characterization methods are also desired; this issue is described in both RF-DD02 and RF-DD04.

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Worker Protection Clothing and Systems (RF-DD08)

Cost effective, durable, safe, and more comfortable personal protective equipment is desired to maximize worker effectiveness while minimizing worker contamination risk. Potential exposures are to both radioactive and hazardous materials. Related to this issue is an opportunity to employ improved real-time field instruments in order to determine the level of protection required, including upgrades and downgrades, as variations in contamination levels occur. The primary driver is cost savings based on improved worker productivity.

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Characterization of Contaminated Surfaces (RF-DD02) (Low Level v. Free Release)

There is an opportunity to implement improved characterization methods for distinguishing between material with radiological contamination corresponding to its final assay as low-level waste and material which meets free (unrestricted) release criteria. This opportunity is focused on measurement of concrete building surfaces before, during, and after demolition. Improved characterization methods prior to building demolition will have implications for whether and where decontamination efforts will be undertaken. During demolition, an ability to classify a building's structure as "clean" will have implications relative to the degree and type of dust control measures and worker protective clothing that will be necessary. After demolition, verifying material as meeting free release criteria will have major implications on the waste management, packaging, and disposal options for building rubble (with related major cost implications). Current characterization methods are adequate for measuring contamination on flat and easily accessible surfaces, but building surfaces that could have cracks and fissures present a greater challenge, especially when trying to measure to levels for unrestricted release. The primary driver is cost savings via reduction of the quantity of material classified as low-level waste.

Improved TRU versus low-level contamination characterization methods are also desired; this issue is described in RF-DD01. A technology opportunity for improved characterization methods for free release of equipment is described in RF-DD04.

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Airborne Particulates Control (RF-DD03)

Improved dust control methods are desired for airborne particulate contamination created during decontamination and size reduction activities taking place within radioactively contaminated buildings. In addition to radioactive particles, there is the potential to generate dust contaminated with hazardous materials such as lead, PCBs, and asbestos. Reducing the generation of dust is generally the preferred option. However, for those situations where there is potential dust generation, improved control systems are desired. A localized system that is portable and easily maneuverable would be beneficial, as the Site intends to carry out many decontamination and size reduction activities *in-situ*. The primary drivers are worker protection, regulatory compliance, and cost savings associated with increased efficiency (faster, easier to use, less labor intensive).

It is not yet clear whether there is a need for exterior dust control methods during actual demolition of buildings. This will depend on the final contamination levels existing within the buildings at the time of demolition. As decontamination efforts within buildings are completed and final contamination levels become known, the need for exterior dust control methods will be re-evaluated. Therefore, for the present time, the focus of this need/opportunity will remain on dust control methods for use inside buildings.

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Characterization for Free Release of Property and Salvageable Equipment Contaminated With Radionuclides (RF-DD04)

As buildings are emptied for demolition, cost-effective methods are desired to rapidly characterize and identify non-contaminated excess equipment so that it can be segregated for free release and ultimate property disposition. Methods will ideally be capable of detecting contamination contained within difficult to access or inaccessible equipment interior spaces and under painted surfaces. An improved accountability and tracking system that includes the full spectrum of information required for disposition decisions is also needed to expedite property disposal. The primary driver is cost savings based on increasing efficiency and reducing the amount of equipment and property that will be disposed of as waste.

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Raschig Ring Removal from Tanks (RF-DD07)

Less labor-intensive methods are desired to remove raschig rings from tanks while maintaining worker radiation exposure to "as low as reasonably achievable" levels. These methods should eliminate the need for radiological enclosures and reduce the level of respiratory protection required. A system that could remove raschig rings from a tank directly into a waste drum without manual assistance from workers would be particularly desirable. The primary drivers are cost reduction and improved worker safety based on application of less labor-intensive methods.

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Decontamination of Porous Surfaces (RF-DD09)

There is an opportunity to implement improved decontamination methods for porous surfaces, primarily concrete structures, such as wall, floors, and ceilings. The primary radioactive contaminants are plutonium, uranium, and americium. In addition, some surfaces may be contaminated with paints containing lead and/or PCBs. Improved efficiency of decontamination methods is desired to reduce worker risk and maintain worker exposure to "as low as reasonably achievable" levels, accelerate schedules, and reduce labor costs associated with performing decontamination activities. Decontamination methods should minimize generation of secondary waste, especially generation of mixed waste. Most of the volume of porous materials on-Site is expected to have low levels of contamination. In some cases, robotics decontamination techniques may be appropriate for highly contaminated surfaces. The drivers are cost and waste minimization, schedule acceleration, and worker safety and ALARA concerns.

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Decontamination of Non-Porous Surfaces (RF-DD10)

There is an opportunity to implement improved decontamination methods for non-porous surfaces, primarily large process equipment structures (gloveboxes, piping, tanks, ductwork). The primary radioactive contaminants are plutonium, uranium, and americium. In addition, some surfaces may be contaminated with paints containing lead and/or PCBs. Improved efficiency of decontamination methods is desired to reduce worker risk and maintain worker radiation exposure to "as low as reasonably achievable" levels, accelerate schedules, and reduce labor costs associated with performing decontamination activities. Decontamination methods should minimize generation of secondary waste, especially generation of mixed waste. Non-porous materials on-Site are expected to exhibit a wide range of contamination levels. In some cases, robotics techniques may be appropriate for highly contaminated surfaces. Methods will preferably be *in-situ* and require minimal disassembly of large process equipment. Decontamination of salvageable equipment should use non-abrasive methods, so that equipment is not damaged. The drivers for this opportunity are cost and waste minimization, schedule acceleration, worker safety, and ALARA concerns.

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Size Reduction of Contaminated Equipment and Demolition Waste (RF-DD11)

Improved techniques are desired to segment, volume reduce, and size reduce TRU and low-level gloveboxes, concrete, sheet metal, piping, conduit, process equipment, furniture, etc. Improvements for both *ex-situ* (centralized) and *in-situ* (decentralized) methods are desired. There are currently more than 900 contaminated gloveboxes at Rocky Flats, tens of miles of process pipe, and thousands of pieces of process equipment. There are dozens of concrete structures which will need eventual demolition. The Site needs size reduction systems that are less labor intensive, faster, and control potential cross contamination. For *in-situ* application, equipment should be easy to operate and maneuver within buildings. In some highly contaminated areas, use of robotics techniques may be appropriate. The primary drivers are cost reduction, schedule acceleration, and worker safety.

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Improved Technology for Recycling Contaminated Scrap Metal (RF-DD12)

The Site desires rapid and cost-effective methods for recycling contaminated scrap metal. Recycling of scrap metal may be accomplished either with or without decontamination. If decontamination is part of the recycling process, the technology should be able to reduce surface contamination levels to allow reclassification of TRU waste to low-level waste (at a minimum) or to allow unrestricted release (preferred). Alternatively, recycling could be accomplished by converting contaminated metals into useful products such as waste drums or shielding (where the presence of small amounts of contamination would not be a problem). The primary radionuclides of interest are plutonium, americium, and uranium. In addition, there is likely a need for recycling technologies applicable to material that is contaminated with hazardous substances such as PCBs, lead, and asbestos, although this need/opportunity is focused on radioactively contaminated scrap metal. Metals of interest include stainless steel, lead, and depleted uranium. Existing technologies are technically feasible; however, due to the large amounts of contaminated scrap metal expected from D&D, more efficient and cost-effective methods are needed if the Site is expected to meets its goal of closure by 2006. The primary drivers are schedule needs, waste minimization, and cost reduction.

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Determination of Appropriate Free Release Level for Property and Salvageable Equipment Contaminated with Beryllium (RF-DD14**)

Rocky Flats requires a technical basis for determining a reasonable free release standard for salvageable property contaminated with beryllium. Regulatory standards do not exist for free release of equipment contaminated with beryllium, and DOE has not yet developed free release standards for beryllium. A better understanding of the potential for exposure from re-entrainment of dust and the potential health effects associated with the exposure is needed before free release standards can be developed. Data are needed to predict the risk associated with resuspension of beryllium dust from equipment. This scientific understanding will allow a technical basis to be used in establishing free release levels. Several other DOE sites will also have to determine free release standards for beryllium. Unless free release standards are developed, thousands of pieces of equipment and property contaminated with trace quantities of beryllium are likely to be disposed of as waste instead of potentially being re-used. The major drivers for this need/opportunity are cost reduction, waste minimization, and future worker safety.

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Environmental Restoration (ER)

Passive Remediation of Chlorinated Aliphatic Solvents in Groundwater (RF-ER03)

The Site desires passive groundwater treatment technologies to remediate plumes of chlorinated aliphatic solvents and dense nonaqueous phase liquids (DNAPLs). The plumes that may be addressed by passive treatment include the Mound Site plume, the 903 Pad/Ryan's Pit plume, and the East Trenches Area plume. The contaminants are tetrachloroethene, trichloroethene, carbon tetrachloride, vinyl chloride, and other volatile organic compounds found in the Rocky Flats Alluvium. The treatment technology in some cases also needs to remove low levels of radioactive material (plutonium, americium, and uranium). The Rocky Flats Alluvium is comprised of clayey sandy gravels with varying amounts of caliche. The depth to groundwater varies across the Site but averages approximately 10 to 15 feet below ground surface. The primary driver is cost savings based on reduced operating and maintenance costs for passive treatment systems compared with traditional groundwater pump and treat (or collect and treat) systems.

Currently, the Site is actively pursuing implementation of reactive barrier technology to resolve this need/opportunity. Bench-scale testing has been completed with good results. Design for a system to remediate the Mound Site plume is nearly complete, and installation is expected in the first quarter of fiscal year 1998. The system will have a funnel and gate impermeable wall and a treatment zone consisting of iron filings. If the system is successful, then this need/opportunity will be resolved and removed from the Site's list of technology needs and opportunities.

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Capping Design for Arid and Semi-Arid Climates (RF-ER08)

The Site requires caps compatible with arid environments to prevent further groundwater contamination and movement of contaminants that are not amenable to source removal. For final Site closure, three caps of 10 acres, 43 acres, and 13 acres are planned in the Industrial Area over the Solar Ponds, the 700 area, and the 300 area. The Site desires cap designs that reduce natural groundwater recharge, provide long life in arid climates, and reduce costs. In addition, the Site is interested in stabilization methods to minimize subsidence, loss of cover integrity, and contaminant migration for the capped areas. The Site is interested in alternative landfill covers that will be more effective, easier to install, and less expensive to install in arid regions.

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Real-time Monitoring of Plutonium and Americium in Sewage Treatment Plant Influent (RF-ER11**)

If current draft language in the Site's National Pollutant Discharge Elimination System (NPDES) permit remains in the final permit, there will be a need to complete and report the results of a feasibility study for improving monitoring of radionuclides in the sewage treatment plant (STP) influent. Radionuclides mentioned in the draft language include plutonium, americium, uranium, and tritium, although plutonium and americium are the primary radionuclides of interest. Even if current draft language does not remain in the final permit, there is still an opportunity for benefits to the STP and the Site from implementing real-time radiation monitoring instrumentation for the STP influent. Currently, the Site is unaware of any real-time monitoring technologies applicable to plutonium and americium. Real-time monitoring of the STP influent, even at fairly high levels, could function as an "alarm" of a radionuclide spike heading toward the STP. An early warning of this type would allow the Site to implement corrective action measures to isolate radionuclide-contaminated wastewater. Isolating contaminated wastewater prior to it entering the STP process lines can prevent a number of negative consequences: generation of radioactively contaminated wastewater sludge, contamination of the STP itself (walls, pipes, etc.), and possible STP discharge of radioactively contaminated water to downstream locations. The primary driver for completing a feasibility study is regulatory compliance. The primary drivers for implementing real-time monitoring capabilities are cost and risk avoidance by protecting the STP from potential radionuclide contaminant spikes.

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Passive Remediation of Uranium Nitrate Groundwater Plume (RF-ER12**)

The Site desires passive groundwater treatment technologies to remediate the Solar Ponds plume (formerly referred to as the OU4 hillside plume). The contaminants of primary concern are uranium, nitrates, and trace amounts of other metals (e.g., tritium and chromium) found in the Rocky Flats Alluvium. The Rocky Flats Alluvium is comprised of clayey sandy gravels with varying amounts of caliche. The depth to groundwater varies across the Site but averages approximately 10 to 15 feet below ground surface. The primary driver is cost savings based on reduced operating and maintenance costs for passive treatment systems compared with the current system, which is groundwater collection and treatment by evaporation in Building 374.

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Spent Nuclear Materials (SNM)

Measurement of Hydrogen Gas Generation Rates to Justify Increased Drum Wattage Limits (RF-SNM01)

There is a need for measurement and validation of hydrogen equilibrium gas generation rates to provide a technical justification for an increase in the WIPP drum wattage limits. An increase in the drum wattage limits would reduce the volume of waste to be transported to WIPP, reduce the volume of drums requiring repackaging, and minimize the post-processing mortgage costs for on-Site storage of residues. To gather the data to justify the increase in wattage limits, a system must be available to complete hydrogen gas generation testing on up to 870 WIPP-destined "test category" residue drums (170 inorganic residue drums and 700 organic residue drums) currently at the Site by the end of fiscal year 1999. The number of drums required to be tested may be much less than 870 if statistical analysis is successfully applied to the results of the initial tests. The "test category" drums are those drums on-Site that currently exceed the wattage limit for their particular shipping category. If there is no treatment of these residues, they must be tested and/or repackaged prior to shipment and disposal at WIPP. Even if treatment takes place on the organic residue inventory at the Site (nearly 900 drums), there remains the opportunity for use of a hydrogen gas testing system. Current projections indicate that organic/combustible residue treatment will result in approximately 3,000 drums. Hydrogen gas testing capabilities that can be implemented in time to support the residue treatment process could reduce that number by a factor of two, to 1,500 drums.

There is no certified technique approved by WIPP for this measurement at this time although there is a national working group addressing the problem. An increase in the wattage limits would reduce the number of residue drums that would potentially be shipped to WIPP. The primary driver for this need is cost reduction by minimizing the number of drums of TRU/TRM and residue wastes that will be repackaged and shipped to WIPP for disposal.

This need is similar to the one described in the RF-WM03 template.

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Plutonium Interim Storage Surveillance (RF-SNM08)

There may be a need for non-invasive, non-intrusive interim storage surveillance techniques at the Site. Whether this need truly exists will be dependent on Site schedules for shipping special nuclear materials off-Site. Should the Site meet the current goal to start shipping all special nuclear material off-Site in 2002, this need will no longer be valid. However, should shipping schedules be delayed, the need will remain. Interim storage surveillance techniques are needed to allow monitoring of storage conditions without violating the storage containers or producing waste. In addition, an accountability and tracking system is needed as part of the surveillance requirements. The primary drivers are worker safety and cost savings.

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Waste Management (WM)

Certified Process for TRU/TRM Hydrogen Gas Generation Measurement (RF-WM03)

There is a need to establish a hydrogen gas generation measurement process for TRU/TRM waste contained in 55-gallon drums. WIPP waste acceptance criteria require that hydrogen gas generation in TRU/TRM waste sent to WIPP for disposal be less than 5% by volume. Individual payload containers that exceed the limit must be tested. There is no certified technique approved by WIPP for this measurement at this time, although a national working group is addressing the problem. This is a DOE complex-wide need. The primary driver is cost reduction by minimizing the number of drums of TRU/TRM and residue wastes that will be repackaged and shipped to WIPP for disposal.

This need is similar to the one described in the RF-SNM01 template.

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Improved Sensitivity for Plutonium Non-Destructive Assay (NDA) Instrumentation (RF-WM04)

Improved methods are needed for accurate NDA of low-level wastes to classify and segregate wastes for shipment to off-Site disposal facilities. Improved sensitivity down to 1 nCi/g is needed in order to meet applicable disposal site waste acceptance criteria (and increase off-Site disposal options. The need is to provide accurate NDA technology for low-level waste and low-level mixed waste having radionuclide contamination between 1 and 100 nCi/g. The primary driver is the waste acceptance criteria for the disposal facilities and subsequently cost.

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Bulk Debris Characterization Techniques (RF-WM12**)

Non-destructive assay (NDA) techniques are needed to characterize and certify for disposal the chemical, physical, and radiological attributes of bulk building demolition rubble and debris that would be packaged in large 20 cubic yard roll-off type containers. Current NDA techniques are focused on radionuclide assay of 55-gallon drums and 4x4x7 crates. However, the future of the Site will include the use of large roll-off containers for dispositioning demolition debris. The capability is needed to non-destructively verify that the debris meets the proposed disposal site waste acceptance criteria for both hazardous and radioactive constituents. The vision of such a device could include a "drive-through" scanner similar to those used at existing commercial landfills. The primary driver is cost savings and schedule improvements based on increased efficiency and reduced need for repackaging.

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Non-Destructive Assay (NDA) of TRU/TRM Drum Headspace for Organic Contamination (RF-WM07)

A non-destructive technique to analyze the head space of TRU and TRM drummed waste for organic compounds is desired that will not destroy the integrity of the drum filter. Alternatively, a drum lid filter that does not have to be replaced after sampling (such as a septum) would address the need/opportunity. All drums of TRU and TRM waste to be disposed of at the WIPP must have a headspace analysis for flammable volatile organic compounds per the requirements of the WIPP waste acceptance criteria. Currently, after sampling the headspace of a waste drum, the filter must be replaced since the sampling process punctures the filter. Replacing the filter is expensive from a labor and materials standpoint (each filter costs approximately $25). In addition, there is potential to reduce worker exposure to ionizing radiation and hazardous constituents in the waste if an NDA technique is instituted. Approximately 5,000 drums of waste are in storage that must be screened for organic contamination in the headspace. This number does not include the number of drums of TRU/TRM waste that will be generated during D&D activities and treatment and repackaging of residues. Estimates for the number of waste drums to be generated in residue treatment and repackaging operations alone range from several thousand to tens of thousands. The primary drivers are cost savings based on increased efficiency and reduced handling as well as worker safety.

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Infrastructure (IF)

Automated Training Infrastructure (RF-IF01**)

"Just-in-Time" and consequences-based training platforms are needed to facilitate closure of the Site. A computer-based training development and delivery system is desired that enables creation of and changes to training materials to be virtually automated. Such a system could change the training development process from months to hours. Delivery of the training material should be computer driven in a web-based format to allow for automated tracking and management. Via this mechanism even traditional, regulated safety training could be delivered in a more streamlined fashion. In addition, computer-driven, virtual reality technology should be available to deliver performance-based aspects of training (consequences-based training). This computer-based approach should reduce the need for instructors to 10 to 15% of current staffing levels. The primary driver for this need is cost reduction based on more effective and less labor intensive training methods.

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